

Power u^n _ _ _

Two cases occur: a numeric integer n , and a gerund n .

Numeric case . The verb u (or $x&u$) is applied n times. For example:

[] ; +/\ ; +/\^:2 ; +/\^:0 1 2 3 _1 _2 _3 _4) 1 2 3 4 5				
1 2 3 4 5	1 3 6 10 15	1 4 10 20 35	1 2 3 4 5	1 2 3 4 5
1	3	4	6	10
1	6	10	15	20
1	10	20	35	50
1	15	35	70	105
1	20	45	90	135
1	30	75	150	225
1	40	100	200	300
1	50	150	300	450
1	60	210	420	630
1	70	280	560	840
1	80	360	720	1080
1	90	450	900	1350
1	100	550	1100	1650
1	110	660	1320	2090
1	120	780	1560	2640
1	130	910	1820	3300
1	140	1050	2100	4060
1	150	1200	2400	4950
1	160	1360	2720	5980
1	170	1530	3060	7160
1	180	1710	3420	8500
1	190	1900	3800	10010
1	200	2100	4200	11700
1	210	2310	4620	13580
1	220	2540	5060	15640
1	230	2790	5520	17890
1	240	3060	6000	20440
1	250	3350	6500	23290
1	260	3660	7020	26460
1	270	3990	7560	30000
1	280	4340	8120	33920
1	290	4710	8700	38250
1	300	5100	9300	43000
1	310	5510	9920	48180
1	320	5940	10560	53800
1	330	6390	11220	59960
1	340	6860	11900	66680
1	350	7350	12600	74000
1	360	7860	13320	81940
1	370	8390	14060	90540
1	380	8940	14820	99920
1	390	9510	15600	110100
1	400	10100	16400	121120
1	410	10710	17220	133000
1	420	11340	18060	145760
1	430	12000	18920	159440
1	440	12680	19800	174080
1	450	13390	20700	189720
1	460	14130	21620	206400
1	470	14900	22560	224160
1	480	15700	23520	243040
1	490	16530	24500	263080
1	500	17390	25500	284320
1	510	18280	26520	306800
1	520	19200	27560	330560
1	530	20150	28620	355640
1	540	21130	29700	382080
1	550	22140	30800	409920
1	560	23180	31920	439200
1	570	24250	33060	470000
1	580	25350	34220	502320
1	590	26480	35400	536240
1	600	27640	36600	571800
1	610	28830	37820	609040
1	620	30050	39060	648000
1	630	31300	40320	688800
1	640	32580	41600	731440
1	650	33890	42900	775920
1	660	35230	44220	822360
1	670	36600	45560	870800
1	680	38000	46920	921280
1	690	39430	48300	973840
1	700	40890	49700	1028520
1	710	42380	51120	1085360
1	720	43900	52560	1144400
1	730	45440	54020	1205680
1	740	47010	55500	1269240
1	750	48610	57000	1335120
1	760	50240	58520	1403360
1	770	51900	60060	1474000
1	780	53590	61620	1547160
1	790	55310	63200	1622880
1	800	57060	64800	1701200
1	810	58840	66420	1782160
1	820	60650	68060	1865800
1	830	62490	69720	1952160
1	840	64360	71400	2041280
1	850	66260	73100	2133200
1	860	68190	74820	2228040
1	870	70140	76560	2325760
1	880	72120	78320	2426400
1	890	74130	80100	2529960
1	900	76170	81900	2636400
1	910	78240	83720	2745840
1	920	80340	85560	2858320
1	930	82470	87420	2973880
1	940	84630	89300	3092560
1	950	86820	91200	3214400
1	960	89040	93120	3339440
1	970	91290	95060	3467600
1	980	93570	97020	3598960
1	990	95880	99000	3733440
1	1000	98220	101000	3871080

An infinite power n produces the limit of the application of u . For example, if $x=:2$ and $y=:1$, then $x \circ.^:_ y$ is 0.73908, the solution of the equation $y=\text{Cos } y$. If n is negative, the obverse $u^:_1$ is applied $|n|$ times. The obverse (which is normally the inverse) is specified for six cases:

- The self-inverse functions $+ - . \% \% . | . | : / : [] C . p .$
- The pairs in the following lists:
 $< <: + . +: +~ * . *: *~ ^ , : ,~$
 $> >: j ./ "1" _ -: -: r ./ "1" _ \%: \%: ^ . { . (< . @ - : @ #) & { .$
 $i: # . " . ; ~ 3!:1 3!:3 p: q:$
 $i@ (, & ' ' & . > " 1) #: " : > @ { . 3!:2 3!:2 \pi(n) */$
 $\backslash: o . j . r .$
 $/: @ | . \% & (o . 1) \% & 0 j 1 \% & 0 j 1 @ ^ .$
- Obviously invertible bonded dyads such as $-&3$ and $10&^ .$ and $1 0 2&|:$ and $3&| .$ and $1&o .$ and $a.&i .$ as well as $u@v$ and $u&v$ if u and v are invertible.
- Monads of the form v/\backslash and $v/\backslash .$ where v is one of $+ * - \% = ~:$
- Obverses specified by the conjunction $: .$

Continued

Power $u^{:n}$ _ _ _

Continued

6. The following cases merit special mention:

$p^{:n}$ gives the number of primes less than n , denoted by $\pi(n)$ in math

$q^{:n}$ is $*$ / $*$

$\#^{:n}$ with a boolean left argument is “Expand” (whose fill atom f can be specified by fit , $b\&\#^{:n}!.f$)

$a\&\#^{:n}$ produces the base- a representation

$!^{:n}$ and $!\&n^{:n}$ and $!\&n\&^{:n}$ produce the appropriate results

Gerund case. (Compare with the gerund case of the merge adverb $\}$)

$x\ u^{:n}(v0\ v1\ v2)y \leftrightarrow (x\ v0\ y)u^{:n}(x\ v1\ y)\ (x\ v2\ y)$

$x\ u^{:n}(v1\ v2)y \leftrightarrow x\ u^{:n}([\ v1\ v2)\ y$

$u^{:n}(v1\ v2)y \leftrightarrow u^{:n}(v1\ y)\ (v2\ y)$

Power $u^{\wedge} : v$ _ _ _

The case of $^{\wedge} :$ with a verb right argument is defined in terms of the noun right argument case ($u^{\wedge} : n$) as follows:

$$x \ u^{\wedge} : \ v \ y \ \leftrightarrow \ x \ u^{\wedge} : (x \ v \ y) \ y$$

$$u^{\wedge} : \ v \ y \ \leftrightarrow \ u^{\wedge} : (v \ y) \ y$$

For example:

```
x=: 1 3 3 1
y=: 0 1 2 3 4 5 6
x p. y
1 8 27 64 125 216 343

x p. ^: (>3:)"1 0 y
0 1 2 3 125 216 343

a=: _3 _2 _1 0 1 2 3
%: a
0j1.73205 0j1.41421 0j1 0 1 1.41421 1.73205

* a
_1 _1 _1 0 1 1 1

%: ^: * " 0 a
9 4 1 0 1 1.41421 1.73205

*: a
9 4 1 0 1 4 9
```

The following monads are equivalent. (See the example of $^{\wedge} T.$ _ in the definition of the Taylor Approximation $T.$.)

```
g=: u ^: p ^: _
h=: 3 : 't=. y. while. p t do. t=. u t end.'

u=: -&3 [. p=: 0&<
(g"0 ; h"0) i. 10
+-----+
|0 _2 _1 0 _2 _1 0 _2 _1 0|0 _2 _1 0 _2 _1 0 _2 _1 0|
+-----+
```